POLIOMYELITIS

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May 1941

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INTRODUCTION

Probably of all the diseases that afflict mankind none strikes such fear to the mind of people as poliomyelitis. This disease commonly known as infantile paralysis has received at the same time too much and too little attention. Too much attention is evident in a community which has or is experiencing an epidemic of poliomyelitis where the inhabitants tend to react in an extremely violent manner, even to the point of hysteria regarding this disease. Certainly they react out of proportion to the actual menace, which should become evident as we delve further into the subject.

Too little attention is given to this disease by the public from the standpoint of research into the cause of this dread disease and to the actual care and rehabilitation of its victims. Too often we begrudge money spent on research because results are not instantaneous. Sometimes we see crippled persons pathetically walking along the street or seeking work which they may do, with little thought as to the person as an individual and his need for our understanding and cooperation. Actually almost no victim of the disease need become a permanent public charge, but this cannot become a reality unless those of us who are well are willing to do our part in assisting our crippled neighbors.

Poliomyelitis is a disease which should be understood particularly by nurses so that they in turn may help the public in their understanding of the disease. We should recognize that poliomyelitis is only one part of the problem pertaining to the crippled people throughout the world but that it is an important

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phase of this problem.

I choose this subject for a paper because it is such a popular one today and yet about which I actually knew very little. I not only wanted to find out just what to know and believe about the disease for my own interest, but so that I would better know how to help others in a similar dilemma.

Literally hundreds of persons have studied and written about this disease. I found it difficult to choose just what I should read because the supply seemed unlimited. Almost weekly, it seems, new discoveries are being made that are vitally related to the future of this menace, poliomyelitis. It is the sincere wish of every person who has ever seen a vitims of poliomyelitis that some day this disease will yield the mystery which surrounds it and thus end the tragedy which it brings.

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Part One

HISTORY of POLIOMYELITIS

Poliomyelitis is a most interesting disease from the standpoint of its history. It has been termed both an ancient disease and a new one. Drs. John Ruhrah and Erwin Mayer state that it is a "disease of recent origin". Other authorities agree with these two in the theory that poliomyelitis might be termed a modern disease since the first accurate description of it was given by Michael Underwood in 1784 in his "Diseases of Children".[1] On the other hand there are researchers in the study of poliomyelitis who feel that as far back as Biblical times the disease was known. In II Samuel 4:4 we find reference to the paralysis of Saul's son which may have been due to poliomyelitis. Dr. Draper[2] in his book on this disease has as the frontispiece a picture found carved on an Egyptian tombstone (1580-1350) showing a young man with a definitely withered limb which may have been caused by poliomyelitis. To further emphasize the age of this disease Dr. Draper states that Hippocrates reported on an epidemic which may very likely have been polio, and Galen commented on attacks of paraplegis which, he said, "were brought on by the cold winds of winter succeeding to a humid autumn."[3]

If this disease is really old, one wonders just what treatment the victims received at the hands of the more fortunate populace. History tells us that with few exceptions crippled children were shunted aside or forcibly put out of their misery. Not only was a crippled child a burden upon others and good only for begging or for ridicule, but in addition his infirmity was

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1. Ruhrah, John and Mayer, E.E. Poliomyelitis in all its Aspects pg. 17
2. Draper, George. Infantile Paralysis. pg. frontispiece.
3. Ibid., pg. 10.

often considered to be caused by an evil spirit, therefore to remove or abuse the cripple was to remove or abuse the evil spirit. Almost without exception a child crippled in body, was considered crippled in his mind. The crippled child today, particularly that child crippled by poliomyelitis, is indeed fortunate compared to those unfortunate children long ago, for increasing provisions are being made for their welfare. In 1832 the first institution for crippled children was established and though such work grew slowly, today a crippled child might almost be said to be a special child of the government.

We can date the actual recognition of poliomyelitis as a distinctive disease to Michael Underwood. Following his report a few other cases were reported. Nearly every physician noting the disease at this time attributed it to some defect in weaning or in teething. In 1835 John Bedham in England described four cases exceptionally well but could give no plausible explanation as to the cause. Five years later Jacob von Heine contributed to the meager knowledge about poliomyelitis by writing that the paralysis followed an actue disease and was a disease of the spinal cord. Heine was actually an orthopedic surgeon and approached the disease from the aspect of treatment of the paralysis. He observed at least twenty-six cases of varying degrees of paralysis and no doubt took pride and interest in trying various methods of correcting the paralysis and particularly the deformity so that the children could make some effort towards living a normal life. Heine's monograph is a volume of seventy-eight pages with seven full-page plates showing some

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twenty-two figures illustrating deformities before and after correction. He discussed the symptomatology, etiology and the pathology as well as diagnosis and prognosis with recommendations for treatment, including surgery, exercise, baths. Twenty years later Heine published a second edition of his book which was more extensive and from the name "Spinale Kinderlahmung" (Infantile Spinal Paralysis) we probably have taken the common name of Infantile Paralysis.

The first epidemic in America was described by George Colmer in 1843. While in Louisiana in 1841 he observed several cases and came to the conclusion that it was caused by teething. Obviously most of the cases of paralysis occurred in infants since it was so frequently connected with teething or with the process of weaning.

Until 1863 most of the work and study done on poliomyelitis was merely one of recognizing the disease and suggesting causes. In 1863 von Reinecker and von Recklinghausen described the atrophy and degeneration of the ganglion cells and nerve fibers of the anterior horns of the cord. Other observers added to this knowledge giving a better understanding of the pathological aspects of the disease.

In 1881 in a little town in Sweden there was a small epidemic of poliomyelitis. This ominous event was observed by Dr. Bergenholtz, yet it caused no widespread excitement amont other outside doctors for this village was insignificant and small. Then suddenly a real epidemic of poliomyelitis expolded in Stockholm, Sweden. Dr. Medin carefully observed the course of the disease.

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He had ample opportunity for some forty-four children were stricken and many deaths resulted. Dr. Medin realized that this disease could not be longer overlooked and from his work came to the conclusion that this disease was infectious and a disease to be feared. Dr. Medin's pupil, Ivar Wickman, was also keenly interested in the disease and studied another epidemic in 1905. His description of the epidemiology of poliomyelitis was so complete that little has been added since.

As though to lead investigators on poliomyelitis, which had been a more or less sporadic disease, began to take on epidemic characteristics throughout the world. From the standpoint of epidemiology, poliomyelitis is a disease of the present. No satisfactory explanation of this change has been given. One authority writes on this point: "It is curious that the older literature contains not a single reference to any epidemic, although infantile paralysis most certainly occurred. After the appearance of Heine's monographs, and at a time when the literature of the disease was becoming extensive, no mention was made of any epidemic before 1880. It may have been because small groups of cases were not recognized as such, owing to the infectivity of the disease being unknown, or because the clinical differences between the cases caused them to be regarded as examples of different diseases. But when the symptomatology of the commonest type of the disease had been fully described under the name of spinal infantile paralysis, the absence of reports of epidemics can be explained only by the fact that such epidemics did not occur before 1880."[4]

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4. International Committee for the Study of Infantile Paralysis. Poliomyelitis, p. 18.

With the realization that this terror called infantile paralysis was not only infectious but apt to become widely epidemic, came the desire to find the causative agent and the possibility that an immunization substance might be prepared. The first problem was to transmit the disease to some animal so that the disease could be studied objectively in all its various aspects. In the earliest experimental work which was done on animals, bacterial cultures obtained from a variety of sourced were injected in an attempt to produce the lesions of this disease. Rabbits were most frequently used. In many of the animals so treated, nervous symptoms and sometimes paralysis developed. Though no bacteria were found consistently in the cords of these animals, lesions comparable to those found in humans dying of poliojyelitis were discovered. Sometimes some bacteria were found in the cord, but they could never be traced as causing the disease. Following numerous experiments about 1905, Wickman concluded that no definite conclusions could be made until an experimental animal was found which reacted to poliomyelitis the same as man reacts.

Between 1908-10 three groups of observers, working independently, succeeded in transmitting the disease from man to monkey, and from one monkey to another. In the monkey the disease appeared to be identical to that in man. These scientists were Flexner and Lewis in New York, Leiner and von Wiesner in Vienna, Landsteiner and Popper in Paris. With the discovery of a suitable laboratory animal, the present period of experimentation was inaugurated.

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Though the causative agent was known to be a living organism and the disease could be readily produced in monkeys, it was soon discovered that the organism causing poliomyelitis was so small it could not be seen and could merely be described by terming it a filterable virus. It still today has not yet been seen with the human eye, but with constant improvements in microscopes some day this now invisible organism may be seen and studied unhindered.

Experiments soon demonstrated that in monkeys, at least, an attack of experimental poliomyelitis afforded protection to a second inoculation of the virus. The next step in research brought out the presence of a neutralizing or immunizing substance in the blood serum of monkeys and later in humans who had recovered from the disease. This discovery gave impetus to the theory that an immunizing serum could be developed. Literally hundreds of investigators have done research work on this disease with the result that many times some organism has been accused of causing poliomyelitis, and almost equally as often cures or treatments have been suggested. Actually these numerous experiments tended to add confusion to an already existing state of perplexity. However, today the theory still remains that a filterable virus is responsible and no one-hundred percent immunization or treatment agent has been discovered.

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Part Two

EPIDEMIOLOGY

Before delving further into a study of this disease it would be well to have some understanding of the epidemiology of poliomyelitis. Why poliomyelitis, which had occurred in occasional sporadic cases for many years, should suddenly assume epidemic proportions is unknown; but it is definitely recognized now as being epidemic in character. Poliomyelitis is known throughout the world but large epidemics have been confined to the colder climates. It is a reportable disease in most 'so called' civilized countries which may account in part for the increased incidence of the disease. However, at its worst poliomyelitis is a disease of low incidence and relatively low death rate as compared with other more commonly occurring diseases. The specific mortality rate for poliomyelitis is approximately 10% or one out of ten victims die. The percentage of cases, diagnosed with reasonable certainty in which paralysis develops is usually between 25 and at the most 35%, and 65% recover completely. The number of cases that appear in a community during an epidemic is usually so small that the chances for any one person to contract the disease is about one in a thousand. [5.] Even in the same family where exposure is most apt to occur there is seldom more than one case of the disease.

Undoubtedly the tragedy of the disease, particularly from the standpoint of the victim as well as the public, lies not so much in possible death as in the crippling which it causes and which is a constant advertisement of the disease. Of some 312,688 physically handicapped persons under twenty-one

5. Cowdry, E. V. Infantile Paralysis. pg. 2.

years of age in 1936, infantile paralysis was responsible for 6,347 cases.[6] Dr. Cowdry in a recent report stated that "50 to 75% of our crippled children owe their condition to infantile paralysis or tuberculosis."[7] However, today almost no victim of this dread disease need become a public charge and a deformed, twisted child is, today, an admission of someone's carelessness. The fight for control of poliomyelitis and rehabilitation of its victime has taken on a national character as will be seen later.

Although the infectivity of poliomyelitis was early conceded, the means by which the infective agent is transmitted was not so soon settled. Even at the present time there is unanimity of opinion on this question. Theories and possibilities as to the mode of transmission are numerous and include:

1. Direct transfer from person to person, usually through droplet infection.
2. Transmission by milk.
3. Transmission by water.
4. Transmission by fomites.
5. Insect transmission.

The most widely accepted theory as to the mode of transmission is that the causative agent is a filterable virus which is carried and disseminated only by man. In the infective stages, the virus is believed to be present in the nasopharynx secretions and it is conveyed from the infected to the well individual generally by means of droplet infection. Experiments thus far have failed to show the virus of poliomyelitis apart from

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6. National Health Survey. "The Prevalence and Causes of Orthopedic Impairments."
7. Cowdry, E. V. Infantile Paralysis. pg. 1.

naturally infected individuals or from animals or articles that were experimentally infected. The virus causing poliomyelitis has been found on the nasopharynx of the abortive cases and also found in well individuals. This discovery leads to the conclusion that humans may be carriers of this disease without the carrier being infected. It also gives support to the theory that most adults and older children are immune to poliomyelitis due to repeated exposures to these carriers, resulting in the establishment of immunity without having the disease. The presence of unknown carriers may explain somewhat the occurrence of the many cases which cannot be traced to any known exposure.

The well established fact that monkeys and more recently some species of rate can be given poliomyelitis by implantation of the virus on the nasopharynx of these animals lends further weight to this theory as to the mode of transmission.

The transmission of poliomyelitis by milk, water or other infected ingested material has recently attracted considerable attention. Some outbreaks have pointed towards these as responsible agents. Two modern physicians in their research found "that this virus is destroyed by weak disinfectants and exposure to 50° Centigrade for one-half hour; it is resistant to the action of glycerol and can be preserved in the frozen or dried state; it may remain virulent in water or sterile mild for as long as one month and may persist in water despite chlorination."[8].

The virus causing poliomyelitis has actually been isolated from the feces of infected and also well children, indicating its presence in the gastro-intestinal tract. Also the virus

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8. Levinson, S. E. and Lewin, Philip. Infantile Paralysis, Physicians' Manual. p. 6.

has been found in water which given to monkeys has caused the disease. In spite of these facts the question is by no means settled; for while some researchers believe this to be true, others can prove that irregardless of the means of ingestion of the virus, it still causes the disease by entering through the nerves leading from the nasopharynx to the brain. Irregardless of the argument on this point at least eight small epidemics have been directly traced to contaminated milk and water. The first such epidemic was reported by Wickman in 1905 in a district where the son of the dairyman had poliomyelitis and within fourteen days ten other persons who obtained milk from this dairy had poliomyelitis. More recently in the United States in 1930 Dr. E. C. Rosenow reported eight frank and several abortive cases of poliomyelitis in a midwestern college which he attributed to milk. [9.] Water has similarly been blamed and with good reason for the virus has been found in water.

Indirect contagion, or transfer of infection by inanimate objects or fomites, is theoretically possible in any disease in which infection may occur by direct contagion, but the probability that it does very often do so is slight. Thus far the literature does not give any instance of such a mode of transmission causing an epidemic. Isolation technic is carefully carried out in cases of poliomyelitis on the basis that this may occur as well on the basis of carrying the virus from the sick room to the outside by way of the nasopharynx of the nurse, doctor or anyone coming in contact with the patient.

Insect transmission was considered early in the study of poliomyelitis, but the present consensus of opinion is that

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9. International Committee for the Study of Infantile Paralysis Poliomyelitis. p. 462

they play no part as active biological agents in the spread of poliomyelitis and a very subordinate one, it at all, in the mechanical transfer of the virus. This theory is well substantiated with experiments.

Poliomyelitis is a widely distributed disease. No country for which records are available is known to be entirely free from sporadic cases, however, epidemics have been largely confined to the colder climates. The incidence of poliomyelitis increases as one proceeds away from the equator throughout the world, and has tended to increase in the United States as one proceeds toward the Northern States. Recently it has been observed that more and more epidemics are occuring in the Southern States, as though the disease is showing that it will not allow itself to become limited to any geographical area. In the past, however, the Northern States have suffered more epidemics and have had more sporadic cases.

Early reporters on poliomyelitis noted that during an epidemic the rural incidence of the disease tended to exceed the urban, and this has been established in the present day. Over a period of years though, the average rate for rural and urban areas tends to become equalized, due mainly to the fact that actual epidemics occur less frequently in the rural areas than in metropolitan regions.

Both in its endemic and epidemic prevalence, clinical poliomyelitis is characteristically a disease of summer and early fall. The reason for this variation is unknown and, in fact, is questioned by some authorities who believe that the seasonal incidence is actually accentuated by a seasonal

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expectancy on the part of physicians and that the real difference lies, not in the occurrence of the disease, but in its being reported.

Epidemics of poliomyelitis have occurred at frequent intervals since the first one which was recognized as such in 1881. The well-known epidemic that occurred in 1916 in which in New York City along some 9,005 cases were reported with a total of 27,363 cases for the United States still holds the record for the worst epidemic and we hope that it continues to do so. During this epidemic and the succeeding ones, the fear that abounds is almost as disasterous as the epidemic itself. It is this fear that closes schools, places of amusements, and restrains the movements of the children without apparently affecting the course of the epidemic or the number of victims it strikes down. (Refer to chart at end of paper for number of deaths.)

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Part Three

SYMPTOMATOLOGY - PATHOLOGY

Originally only those patients who developed paralysis were were recognized and diagnosed, but as the disease increased in occurence other types were found to exist. In 1896 one investigator, Caverly, first called attention to a non-paralytic type of poiliomyelitis. This type was further studied by Wickman in 1905, whose moncgraph on poliomyelitis is considered a real classic. During an outbreak in Connecticut early in this century, it was demonstrated that the virus of poliomyelitis was present in the nasopharynx of certain children suffering from a mild febrile illness. Other experiments confirmed this discovery. Unfortunately this type of poliomyelitis is difficult to diagnose and the laboratory methods used are too expensive for general use, but the recognition of its existence is important especially from the epidemiological standpoint.

The understanding of the disease of poliomyelitis developed in a hundred years from the purely paralytic type to a disease "Attacking the anterior horn cells of the cord with resulting paralysis to a disease that may involve various parts of the central nervous system, or may give rise only to signs of meningeal irritation--the non-paralytic type--or that may be so mild as to escape diagnosis entirely unless recourse is had to extensive laboratory studies."[10].

Poliomyelitis has been classified as follows:

"1. The abortive type, which cannot be diagnosed except by elaborate experimental studies.

2. The non-paralytic type.

3. The lower motor neuron type, including both spinal and bulbar forms--the common paralytic type.

10. Colze, W. L. The International Bulletin of Infantile Paralysis, p. 14.

"4. The encephalitic type which is very rare.

5. The ataxic type, very rare." [11]

The symptoms of the abortive or the non-paralytic types of poliomyelitis may be extremely mild or rather severe, or the virus may actually be present without any recognized symptoms. Similarily the symptoms of paralytic poliomyelitis vary from a vew or possibly none recognized as such to severe and distressing symptoms with paralysis as the outcome. Symptoms may develop in from seven to fourteen days after exposure.

It is generally believed today by most authorities that almost every one at some time in his life has either had or been exposed to poliomyelitis, and that a large percentage of these cases have not been diagnosed or recognized, due to subclinical symptoms. In this manner most adults have built up an immunity to the disease in much the same manner that adults in general build up an immunity to other diseases such as diphtheria.

Probably the most commonly recognized symptoms of diagnosed poliomyelitis develop about as follows. The child may suddenly or perhaps gradually develop a cold with a running nose or/and a headache. He may feel drowsy, have a loss of appetite, show lack of interest in his surroundings and become irritable, restless and cross. The face often becomes flushed, muscles twitch and the hands may tremble when reaching for an object; the throat is inflamed and fever is usually present. The child may vomit and irregular action of the bowels or bladder may be present. The child is sick enough to want to be left alone. This pre-paralytic stage is easily neglected and overlooked, and the symptoms, rather typical of the common cold, are considered as

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11. Ibid, p. 15

such. Often this is as far as the disease progresses and only through laboratory experiments, examination of the spinal fluid and other tests can it be actually determined that this is a case of poliomyelitis.

Concurrently or following these symptoms the child may develop a stiff neck or a tenderness over the spinal column. Pain in the neck, back, abdomen or extremities or all these places is present and varies in its severity, often becoming extreme with the oncoming paralysis and lessening after the paralysis is actually present. The stiffness of the neck and back is almost a diagnostic feature together with the other symptoms and is undoubtedly due to the inflammation of the meninges of the spinal cord.

Early in the disease the deep reflexes are usually exaggerated and as the disease advances they become diminished and disappear with the paralysis. Sometimes we hear of a person who suddenly develops paralysis, for instance on awakening in the morning a leg is paralyzed. Generally, an investigation reveals that previously this person has not felt quite 'up to snuff' but did not feel ill enough to be disturbed.

Paralysis usually develops on the second or third day of the disease, but it may be delayed and has been known to occur after two weeks, though this is relatively rare. The paralysis is of the flaccid type and develops to its maximum in from a few hours to two or three days from the first appearance of paralysis. The chart on the following page from Dr. Levinson's book gives the phases of the disease with the accompanying symptoms.

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Exposure	Systemic Phase		Pre-paralytic or Meningeal		Paralytic
Incubation Period: 7-14 Days.	24-48 hours Significant history and findings: 1. sore throat 2. nausea and vomiting 3. malaise 4. fever 5. pharyngitis 6. normal spinal fluid	Complete Recovery in 95%	1-5 Days Invasion of Central Nervous System with development of: 1. headache 2. stiff neck 3. stiff back 4. tremor 5. prostration 6. head drop. 7. muscle tenderness 8. reflex changes 9. abnormal spinal fluid	Recovery without Paralysis in 50%	Early acute period: 1. Disease 2. Active Value of Convalescent Serum indeterminate.
	Diagnosis indeterminate. Patient to be observed for developments.	or Transition Stage 1-4 da.		or Progression 10-50%	
			Clinically diagnostic Period for Convalescent Serum		Chronic Period after Active disease. Conv. Serum of no value.

Various combinations of paralysis may occur but that involving both legs or one leg appears to occur most frequently, but almost any muscle may be involved with varying degrees of paralysis from weakness to complete loss of power.

If the disease process involves the respiratory center in the brain or the muscles or respiration, death is almost imminent unless artificial respiration is provided immediately. Partial paralysis of the respiratory muscles may lead to death through broncho-pneumonia particularly if the condition is not recognized and adequate care given.

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12. Levinson, S. E. & Lewin, Philip. Infantile Paralysis, Physicians' Manual. p. 14.

The bulbar type of poliomyelitis is that involving the medulla. Generally it is associated with the spinal paralysis but the purely bulbar type does exist. In this type of paralysis the cranial nerves are involved resulting in paralysis of various muscles of the face, throat, and not infrequently causing tachycardia by involvement of the vagus, or respiratory embarassment either of which would cause death.

The encephalitic and atazic types of poliomyelitis are almost identical to epidemic encephalitis so that often if it is present it is not recognized as paralysis.

Dr. Chuinard of Portland in his study of poliomyelitis has concluded that there are three steps or stages in this disease. The first he classified as the respiratory infection in which the symptoms resemble the common cold. Next is the gastro-intestinal stage in which in addition to the respiratory distress, nausea and vomiting and frequently either diarrhea or constipation are present. The third stage is the appearance of paralysis. He has found that often in a family where a case of poliomyelitis develops the other members of the family have passed through either the first or both stages of poliomyelitis without progressing onto paralysis. Just why the disease should strike down one person with paralysis and leave others free is a mystery as yet unsolved. This further substantiates the theory mentioned before that most people actually have had or have been exposed to poliomyelitis without their knowledge.

Heine was not only the first to give a scientific description of the clinical manifestations of poliomyelitis, but he was also the first to formulate a hypothesis concerning the pathological

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anatomy, although he was unable to support his theory with a single autopsy of his own. From his vast knowledge and from reading of the work of his contemporaries on the subject of poliomyelitis, Heine came to the conclusion that the disease affected the cord causing irritation and congestion with an active exudate which caused the sudden paralysis. However, he could not explain satisfactorily the fact that the anterior horns are more severely affected than the posterior horns of the cord. Following the publication of his conclusions, other medical men did further work on the pathological aspects of the disease, some confirming and some disagreeing with Heine. The first microscopis study was done in 1863 and with the passage of time and improvement in methods of research additional discoveries were made concerning the pathology of poliomyelitis. The advent of animal experimentation increased the understanding of the changes wrought by the poliomyelitis virus in the body. The present day theory is expressed compactly by Drs. Levinson and Lewin as follows:

"The chief damage in poliomyelitis is to the motor nerve cells of the cord, which undergo destruction. This is accompanied during the acute stages by engorgement of the blood vessels, edema, perivascular and perineural cellular infiltration. The inflammatory reaction is diffuse through the brain and cord as well as both anterior and posterior horns, but is more marked in the horns of the lumbar and cervical regions of the cord. Repair of the destroyed tissue consists of astrocytic proliferation and eventual gliosis, a process comparable to fibrosis elsewhere in the body. Destroyed nerve cells never regenerate.

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been discovered. A clear or slightly opalescent fluid flowing under increased pressure, sterile as examined by smear and culture when collected aseptically; poor in fibrin, reducing Fehling's solution and containing an increased number of cells chiefly of the mononuclear variety, are the most constant findings.in poliomyelitis. An increase in protein and a high potassium permanganate reduction index strengthen the diagnosis."[14].

The history, clinical examinations, and the spinal fluid findings will usually establish the diagnosis in most cases of poliomyelitis, and if the paralysis appears the diagnosis is confirmed.

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14. International Committee for the Study of Infantile Paralysis. Poliomyelitis. p. 197

Part Four

IMMUNITY

One of the most puzzling questions concerning poliomyelitis today is that relating to immunity and resistance to the disease. Why do some people, even though exposed, never contract the disease while others with no known exposure are lift crippled? Why are some victims only temporarily, mildly paralyzed or not paralyzed at all and others are severely maimed with paralysis for life? Thus far these questions cannot be answered with conviction but this is not because people have not searched for the answers, but because the answers are as elusive as the virus is invisible to the human eye at present.

Clinical and epidemiological observations have indicated that one attack of poliomyelitis usually conferred immunity. Animal experimentation further confirmed this theory, though occassionally the animal developed the disease a second time. That this is unusual is indicated by the fact that "out of more than 1800 monkeys used at the Rockefeller Institute, in only two was an extension of paralysis observed as a result of the injection of a large dose of virus several months after recovery from one attack of the experimental disease."[15]. "A total of twenty-six cases of poliomyelitis in which second attacks occurred have been recorded"[16] but in almost any infectious disease instances can be cited in which the disease reoccurred.

The knowledge that immunity followed an attack of the disease led to research for the neutralizing substance. Two investigators, Netter and Levaditi, in 1910 found that an effective dose of the virus could be neutralized by the addition of immune

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15. Ibid. p. 113
16. Colze, W. L. The International Bulletin of Infantile Paralysis. p. 19.

serum obtained from convalescent humans. Following this discovery numerous experiments were undertaken, chiefly with the hope that an immunizing agent might be found that could be used to establish immunity. Confusion was one result, but out of it has come the present day concept of neutralization. In 1936-7 Drs. Schaeffer and Muckenfuss with the financial assistance of the National Foundation for Infantile Paralysis undertook to study the neutralization test in relation to poliomyelitis and to establish a reliable and consistent procedure for qualitative and quantitative determinations on serum-virus reactions. Their work was done with the utmost caution and integrity so that absolutely reliable results would be obtained, but they were not satisfied that this test is a satisfactory method of determining resistance or immunity to infection by the poliomyelitis virus. These men concluded that "it is believed that the test is a specific, antigen-antibody reaction; and although there is some correlation between the demonstration of neutralizing substances and the blood and exposure to the virus, its presence does not necessarily constitute resistance to infection. Since with the test in its present form quantitation is not a practical procedure, and certain problems are excluded from the scope of investigation, improvement or replacement of the neutralizing test is desirable for the advancement of immunological knowledge in poliomyelitis."[17].

The use of serum to produce passive immunity is a much debated and questioned problem. In order for the serum to be of value, if it is possible for it to be of value, an early diagnosis must be made for the serum must be given before any paralysis develops.

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17. Schaeffer, Morris & Muckenfuss, Ralph. Experimental Poliomyelitis. p. 143.

Once paralysis has taken hold the serum is generally accepted as being valueless. This serum is obtained from persons who have recovered from poliomyelitis, on the theory that it contains immune bodies which may newtralize the poisons. At present this theory is still unproven, but one feels that if there is even the slightest possibility that paralysis may be prevented through use of the serum then it should be given. The main difficulty, aside from the questionable value of the serum, is giving it before paralysis develops because the disease is so often not diagnosed until the paralysis actually appears. During an epidemic some authorities feel that it should be given on a more or less wholesale basis.

Dr. Cowdry has suggested that one method of protecting the children during an epidemic is to attempt to give them passive immunity through the use of either convalescent serum or their parents serum. In this case the parents serum is considered almost as potent as convalescent serum on the theory previously mentioned that most adults have actually had the disease. In the same article Dr. Cowdry tells of an experiment in Bradford, Pa. conducted by a Dr. William Brebner who during an epidemic gave serum to 1300 children out of a possible 4,000 to 4,500 children. Thirty-two cases of poliomyelitis developed but none were among the 1300 protected with their parents serum. [18]

In 1929 during an epidemic in Ontario, Canada, convalescent serum was given with the results depicted in the accompanying graph showing that if the serum was given early enough, no paralysis developed. Of some 387 cases receiving the serum a total of 260 cases of 67% recovered. However, it is possible

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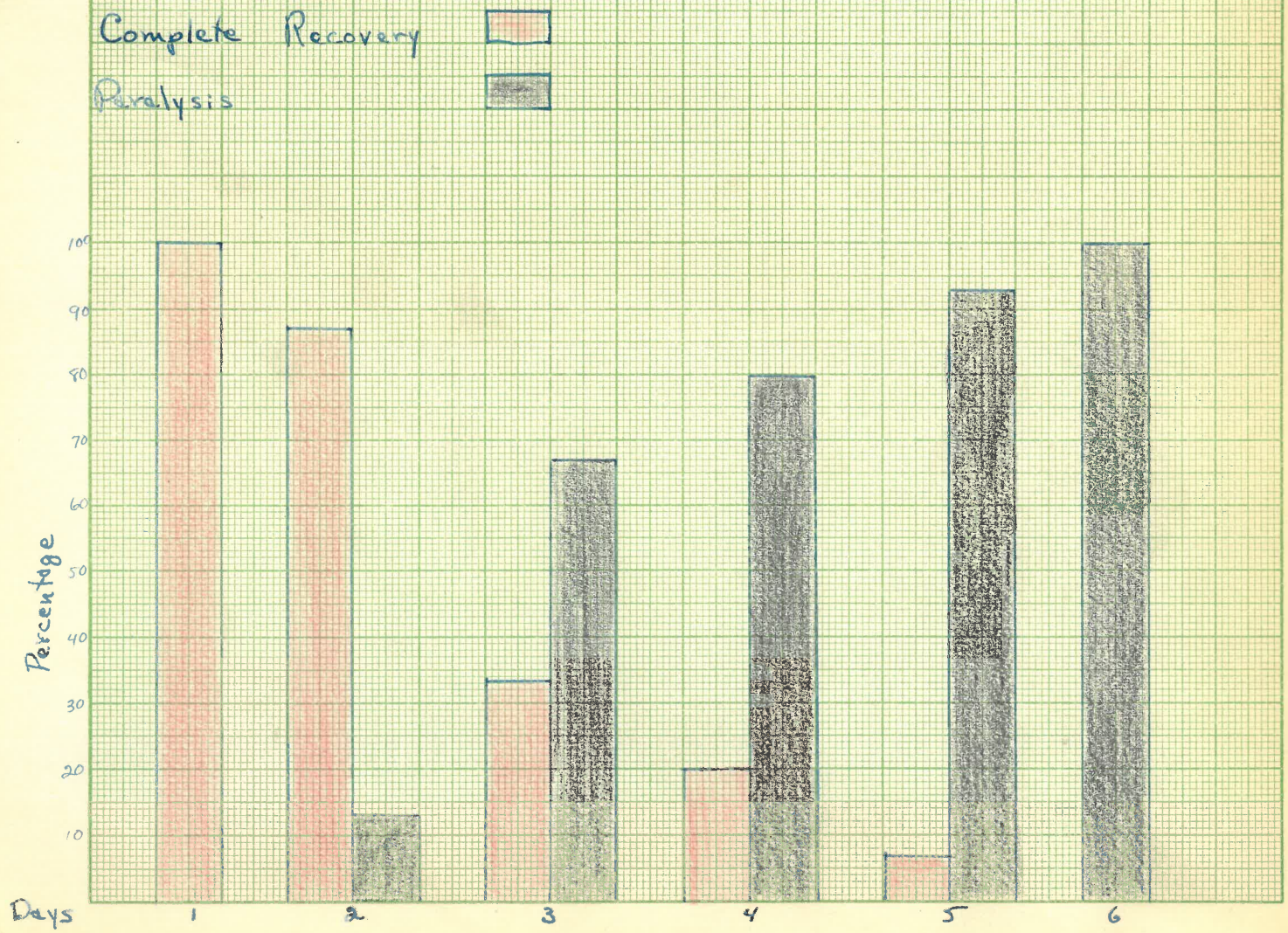
18. Cowdry, E. V. Infantile Paralysis. p. 2.

Serum Therapy in Poliomyelitis



Hardman, R.P., McKay, A.F. - "Poliomyelitis in Ontario in 1929".

that these children would not have been paralyzed anyway since the rate for recovery has been considered to be approximately 65%.

Here in the United States, Illinois used the serum therapy in 1930 with such apparently satisfactory results that free sera is now provided by the state to physicians desiring to use it. Their procedure includes collection of sera from convalescent persons, this is then mixed and prepared carefully and tested on animals. The first injection of 15-20 cc. is given intraspinally, occasionally as much as 50-100 cc. is given. Intravenous or intermuscular injections are given on the second and third days. Results of this therapy first used in 1930 are:

	treated	untreated
"Mortality	0.9%	14.0%
No paralysis	36.0	1.2
Average total paralysis	19.0	65.6
% of cases in which paralysis of severe grade developed." 19.	5.7	46.0

On the other hand, equally eminent authorities feel as stated by Dr. Whitman. "It is a comfort to the parents and the doctor to feel that everything possible has been done for the afflicted child, but I do not feel that serum has ever been demonstrated to have any other than a moral value."[20] Dr. Paul de Kruif similarly reports that during the epidemics in New York and in Connecticut in 1931 when every other poliomyelitis victim was given serum and the remainder were not, no noticeable difference could be noted in the number paralyzed, or those who died.

Other methods have been tried to prevent poliomyelitis. Since the virus is believed by most researchers to enter the central nervous system through the olfactory nerve, several

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19. Shaughnessy, Howard & Thomas, Henry. Infantile Paralysis. p. 11.
20. Whitman, Armitage. From Head to Foot. p. 69

workers by removing this nerve from certain monkeys found that they could not contract poliomyelitis nor could they smell. This was felt to be unpractical for the human race for the attack rate with paralysis is believed to be so low that the chances are the child will not contract poliomyelitis anyway so why force this procedure on him.

The use of a spray in the nasopharynx where the virus is believed to gain a hold was first attempted by Dr. Armstrong of the United States Public Health Service early in 1935. Using monkeys in whose noses he first put alum spray and then the virus of poliomyelitis, Armstrong found that a large proportion of the monkeys did not develop even the symptoms of poliomyelitis. Alum, however, was extremely irritating to the membranes and consequently inadvisable for children particularly. Continuing his work Dr. Armstrong eventually used a dilute solution of picric acid with successful results in monkeys. Since then other chemicals including tannic acid, acriflavine, mercurochome and zinc compounds have been used. These chemical agents were used prophylactically during three epidemics recently--one in Alabama in 1936, one in Canada in 1937, and one in Nicaragua in 1938. The conclusion is that thus far this method is not practical for several reasons chief of which are: short time it renders protection, danger of permanent damage to the sense of smell.

Vaccines have also been made and used but with no success. One vaccine was actually responsible for a few cases of this disease since it contained virulent virus which caused the disease.

Science is still searching for the answer. Not only is science seraching for the solution to the prevention of poliomyelitis but also to other virus diseases, and one feels that someday the wily virus will be forced to give up its secret.

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Part Five

TREATMENT

Prophylaxis might well be considered as the most important phase of poliomyelitis. Thus far prophylaxis consists mainly of protecting children from undue exposure where ever possible. Recently the National Foundation for Infantile Paralysis issued a statement regarding prophylaxis in poliomyelitis in which they said: "Don't take heavy exercise, or get chilled, when you are having headaches, intestinal upsets, fever or unexplained pains in the back of the neck. Nor even when you just don't feel well. This rule applies particularly to swimming, and perhaps explains why in the past swimming has been rather unjustly blamed for many persons catching infantile paralysis. President Roosevelt's attack came after swimming, in exactly the manner described in today's warning.

"The reason for the new 'don't' is a report from Albert Sabin, M. D., Cincinnati, that a harmless form of infantile paralysis may be changed into the paralyzing one. He said that in mild cases the virus which causes the disease appears to spread only to the spinal cord and lower brain.

"But heavy exercise may spread the virus into the higher brain centers, where it injures the muscular controls, and so results in paralysis.

"He said a history of heavy exercise, playing ball, swimming, hiking, etc., is very frequently given by patients with paralytic infantile paralysis. Limited inquiries, moreover, have shown that usually this exercise preceded the paralysis by less than 24 hours.

"Sidney O. Levinson, M. D. of Chicago reported monkey experiments showing that something similar happens to animals chilled

by cold water. This, the foundation stated, would indicate the necessity of guarding humans with the disease against chilling.

"Dr. Sabin's findings also revived an idea which the medical profession had almost abandoned, namely, that you catch infantile paralysis through the mouth, that is by what you,eat, drink or place in your mouth.

"Recently the accepted belief was that the disease entered through the nose, via the nerves of smell. Dr. Sabin said that no virus was found in the noses of persons sick with infantile paralysis, nor in the olfactory nerves of 12 persons who died of the disease."[21].

The treatment of poliomyelitis depends on the severity of the disease and the resulting paralysis. During the pre-paralytic stage the main treatment consists of rest in bed, adequate diet and elimination and sedatives as indicated for the pain and restlessness accompanying this stage. Isolation precautions should be observed since this disease is definitely recognized as being communicable. During this stage if the disease is diagnosed, frequently serum therapy is given with the hope that paralysis may be averted. This is given on the theory explained previously that the serum from persons who have recovered from poliomyelitis contains immune bodies which may help the victims body overcome the virus and prevent paralysis. This therapy though questioned as to the actual value is used throughout the nation with the hope that it may prevent paralysis.

Probably one of the most important considerations during this pre-paralytic or febrile stage of poliomyelitis is to be

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21. Blakeslee, Howard W. "New Infantile Paralysis 'Don't, Beware of Heavy Exercise." Oregon Journal, Friday, May 16, 1941.

on watch for any indications of paralysis. It is particularly important to watch for paralysis affecting the muscles of respiration. Cessation or interference with respiration may result from paralysis in the respiratory center in the medulla or from paralysis of the muscles of respiration or from paralysis of the pharynx resulting in the collection of mucus around the glottis of the patient causing shallow, irregular breathing. The majority of deaths from poliomyelitis are caused by this paralysis, which in many cases might be prevented if artificial respiration is started in time. Not infrequently paralysis of the heart muscles occurs causing immediate death.

The use of the respirator in poliomyelitis is an accepted procedure today. The public tends to feel that all patients with difficulty in breathing can be helped by this machine, but occasionally the use of the respirator may actually be harmful and of no use. Paralysis of the primary muscles of respiration is an indication for a respirator and in all these cases the respirator is consistently helpful. In paralysis of the nerve centers in the medulla the respirator is occasionally but not always of value, and in paralysis of the pharyns with resulting embarassment of respiration, the respirator may actually be harmful. Frequently the last two types of paralysis are associated with heart paralysis in which case nothing can be done.

The respirator serves as a method to provide physiologic rest for the muscles of respiration and should be used as one would use a splint to immobolize or put at rest some other part of the body. Not infrequently the respirator must be used for many months; but often it is necessary only until all muscle

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tenderness and fever have disappeared at which time tha patient is gradually weaned from use of the respirator.

Paralysis of any other muscles may occur at any time from the onset of the disease . As soon as paralysis is noted, treatment must begin in order to prevent deformity. The paralysis may vary from a slight paralysis with only a small amount of decrease in movements or may be severe flaccid paralysis. It may involve only a few muscles scattered over the body or may be so extensive that is seems as though every muscle in the body is affected.

The first consideration when paralysis is found to be present is to apply protection to the weakened or paralyzed muscles. There should be no attempt to give a muscle examination, but merely an attempt to determine what parts of the body are involved through gross examination of joint movements, so that the body may be placed in a neutral rest position.

Until recent years a person stricken with poliomyelitis was practically doomed to become not only crippled from the paralyzed muscles, but deformed due to lack of adequate care and little or no understanding of the proper prophylactic treatment to prevent deformity. Early in this present century Dr. Charles Caverly, president of the Vermont State Board of Health, realized that the victims of poliomyelitis were receiving no after care to prevent deformities. In 1914 he initiated a three-point program:"1. educational campaign for the purpose of giving the medical profession in the state the latest knowledge in regard to the diagnosis and prophylaxis of this disease, 2. original research work into the nature of the

infection, its methods of distribution, diagnosis, immunity. 3. treatment of paralyzed cases."[22]. Other groups followed the example set by the state of Vermont. In spite of their work, however, the widespread epidemic of 1916 left numberless tragically crippled and deformed children as living examples of the power of poliomyelitis and the neglect of the children. Today poliomyelitis followed by deformity is becoming more and more a thing of the past, for the increased knowledge of the disease by the layity has led to support and understanding of adequate care of its victims.

When paralysis occurs during poliomyelitis, one can make no estimate of the injury to the anterior horn cells of the spinal cord, but must deal with the muscles presenting varying degrees of weakness or paralysis. The degree of recovery depends on the treatment received and the extent of damage to the cells of the cord. The cells actually destroyed will not recover, but cells only injured by the virus and/or its toxin may recover and allow the nerve fibers to the muscles to regenerate. Time alone can determine the extent of this nerve recovery, and it cannot be hurried in any known manner. As a rule the longer the actual stage of paralysis lasts, the more degenerative changes take place and the more permanent they may be.

Since there can be no time measure of the injury to nerve cells except in so far as it can be measured in terms of recovery in muscle power, the muscles themselves are the organs that need the most attention. Treatment therefore consists in keeping them in the best possible condition so that as the nerves regenerate they will be in the best possible condition to

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22. Caverly, Charles S. Infantile Paralysis in Vermont. p. 132.

function. One should prevent as much as possible any injury to the muscles that might come from stretching or from excess handling.

At all times the muscles involved should be in positions of rest and relaxation. Immediately after paralysis has occurred, proper splinting of the muscles involved should be carried out to provide rest. Delay in applying protective measures allows the paralyzed or weakened muscles to sag and stretch and the well muscles to pull and thus cause deformity.

"The simplest position of rest for a patient in bed is a neutral position simulating the upright position: namely, with the feet at right angles to the legs, knees flexed five degrees, legs abducted ten degrees. The abdominal muscles should be relaxed with the trunk slightly flexed, and the arms should be abducted at a severy-five degree angle. The forearms are placed midway between pronation and supination, the wrist slightly in extension, the palm cupped. The thumb should be placed in abduction in moderate apposition. The patient should be moved as little as possible during nursing care and the general alignment of the joints and muscles as far as possible should be maintained as previously described." 23.

For several weeks following paralysis the affected muscles will be sensitive and this fact together with the importance of protecting the muscles from stretching and handling indicates that the patient should not be moved any more than is absolutely necessary, and when moved adequate support should be given to all the joints. A generally accepted treatment is to apply

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23. Colze, W. L. The International Bulletin of Infantile Paralysis. p. 125.

plaster of paris body cast to prevent all movement. General nursing measures including care of the skin, adequate elimination, feeding the patient a well balanced diet are carried on routinely.

The convalescent stage of poliomyelitis begins when muscle tenderness has disappeared--usually six to eight weeks after the onset of the acute symptoms. This period varies in length from one to three years and is that period during which the nerves are becoming regenerated and the muscles begin to take on activity.

The physician now tests the muscles to determine the extent of weakness existing and thus decide the amount and kind of therapy to follow. Rest, however, still continues to be the predominate feature of the treatment. If the patient is being cared for at home, the physician and the nurse must teach the family not only how to care for the patients needs and treatments, but must teach them the utmost importance of continued rest.

A normal healthy muscle put at rest will soon show some atrophy from lack of use. This occurs during the period of absolute rest in poliomyelitis. Gradually the normal muscles must be strengthened and the weakened muscles rebuilt as the nerve impulse returns. Physiotherapy in the form of heat, gentle massage, and exercise is employed to help the muscles return to normal. Passive exercise is done before active exercise is undertaken. This therapy is frequently done by a trained physiotherapist, but is just as often done by the parents in the home under the guidance of the physician, physiotherapist or a nurse.

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It has been found that the muscles fundtion at a higher degree of effieiency when they are warm, therefore often before either massage or light exercise is given, heat is applied to the muscles in the form of a heating pad of warm bath. The use of water or hydrotherapy is not only popular, but is also an important factor in the restoration of function. Massage and muscle training may be given in the water and the buoyancy of the water aids the patient in doing active exercise as his condition permits. As the patient improves he is allowed gradually increased exercise until finally he is permitted to be up with the use of braces. Not infrequently the patient in time may recover enough use of the weakened muscles to permit resumption of normal activity. If this is not possible generally braces can be made that permit him to get about.

There comes a time when a maximum of improvement is reached in the muscles recovering from poliomyelitis. Beyond that time there is nothing to be gained by continuing the rest, protection and physical therapy. When this point has been reached plans are made for operative therapy such as muscle transplantations or joint fixations or other reconstructive surgery. Not infrequently such treatment may take years, but often results in giving the patient an opportunity to return to normal society and within limits to adjust to it. It has been said and proved true that a poliomyelitis patient can always be helped and should never give up home of improvement.

The prognosis for patients suffering from poliomyelitis varies with the degree and extent of the paralysis. The time should never come when a victim of poliomyelitis feels that

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there is no chance for further improvement for some persons have shown varying degrees of improvement after four, six or even ten years. The important element is that care and continued treatment of the muscles must never cease for as they do so ends the possibility of further improvement. As a general rule if the patient has been properly cared for so that no deformity is present other than the paralysis itself, through vocational rehabilitation the individual can in time make enough of an adjustment to live in a normal society. Actually the responsibility for this program rests on the public as much as on the patient.....

Part Six.

REHABILITATION and MODERN PROGRAMS

Before vocational rehabilitation can be utilized successfully, the crippled individual must through elementary education learn the basic fundamentals necessary to live in a society. Education, until rather recent times, was for the benefit of the few and seldom, if ever, was a crippled child deemed capable or necessary in being educated. In the United States the first school for the crippled child was in New York in 1863 under the Society for the Relief of the Crippled and Ruptured. In 1890 the New York City Childrens' Aid Society opened the Rhinelander Industrial School for Crippled Children. Other schools followed these; in almost every instance they were privately conducted schools and the public as a whole felt no responsibility for the crippled children. In 1900 Chicago was the first to assume responsibility for the education of the crippled as well as the well child.

"From these public and private initial efforts, there had developed by 1914 an interest in this country which brought to both types of schools for crippled children 2862 pupils, 988 of whome were in 51 public schools in Chicago, New York City, Cleveland, and Detroit."[24]. Since then the education of the crippled children has advanced not only in the number of pupils and schools, but also in the methods of education used. It is interesting to note how willingly the public now will support any program to aid crippled children. Federal Assistance through the Social Security Act cemented the place of the crippled child in the educational system.

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24. Howett, Harry H. Progress in the Education of Crippled Children. p. 9.

Having obtained elementary education the next step for the crippled child is vocational training. Vocational rehabilitation is by no means limited to those persons suffering from any one disease, but today attempts to include all those suffering from some disease or defect which need particular guidance and training in some vocation which may prove suitable to their needs and ability and personality.

In 1920 Congress passed the Industrial Rehabilitation Act which provided for federal guidance and assistance for the states in providing this service to those persons needing it. Originally it was more or less interpreted as relating to persons injured in industry, but gradually the interpretation has broadened to include more and more groups. Under the Social Security Act of 1935 every State now has a vocational rehabilitation program in effect with some $3,500,000 spent annually by the Federal government and an almost equal amount by the states. This will be further mentioned later.

The main purpose of vocational rehabilitation is defined by the Federal Act as the "rendering of a disabled person, fit to engage in a remunerative occupation." The method in accomplishing this consists of knowing the physical condition of the person concerned so that one can understand the limits placed by physical disability. The personality and intelligence, the individual as a whole must be carefully studied and then together the vocational guidance worker and the patient work out possibilities of employment. Training generally follows with the worker supervising until finally the patient is ready for a position. Again the worker directs the actual employment

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aspect enough to know that all is going as well as is possible. In Oregon two men direct the rehabilitation program for the state.

As proof that handicapped persons can adjust to industry's needs we can refer to the experience of the Western Electric Co. In 1929 this company set up new medical requirements for its employees which permitted handicapped persons to be employed. These persons were classed as 'A-VD' and normal persons were listed as 'A'. The following results were found at the end of a year in a group of 1304 workers of which half were physically handicapped in some way.

"7.9% more 'A' cases resigned that 'A-VD'
2.6% less 'A' cases were laid off due to lack of work than 'A-VD'.
7.4% more 'A' cases relieved because not suited to type of work." 25.

In general this company felt that there was no real reason why people possessing certain vocational defects could not be employed by industrial firms.

As a result of vocational rehabilitation, handicapped persons become producers and not dependents, disabled individuals are transformed from public liabilities to civic assets, skilled workers are returned to industry and family life is reestablished.

One of the most heartening phases in respect to poliomyelitis and all other crippling conditions is the attitude of the public as evidenced in their support of programs for the aid of handicapped persons. Emphasis has been particularly focused on poliomyelitis since President Roosevelt became a national figure for he was and is the living example of this disease and how well its defects can be overcome by the individual.

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25. Dietz, J. W. "An Experiment with Vocationally Handicapped Employees." p. 4.

For many years various persons had done research on poliomyelitis. Private individuals and foundations such as the Rockefeller and the Millbank Foundations had given money to do research on poliomyelitis. Under miscellaneous titles those crippled by poliomyelitis had been assisted. Private groups here and there were each doing their little bit. In 1934 the first President's Ball was given on President Roosevelt's birthday. Throughout the United States people attended these parites. The funds obtained in this manner were given to the Warm Springs Foundation because this was the organization most prominent in poliomyelitis work and because President Roosevelt had been treated there several years ago. Each succeeding year a similar Ball has been given. In 1935 part of the money was retained locally and part given to research. In order to better coordinate the work being done on this disease President Roosevelt in 1937 suggested the organization of a National group. In January 1938 the National Foundation for Infantile Paralysis was organized. This organization cooperates closely with its local chapters of which there are over 1,000 in the United States. The money raised by the Ball each year is distributed equally, the National Organization taking half and the local chapter retaining the remainder.

The local chapters of this organization administer their funds as they deem advisable. The National Organization's purpose has been to do the kind of work that will benefit not only particular individuals, but all those afflicted with this disease. It acts generally as a grant- making agency. Grants-in-aid are given chiefly for research to individuals

or groups doing work on poliomyelitis. Thus far the chief activities have been in five divisions: Virus research, Nutritional research, After-effects research, Epidemics and Education.

The Georgia Warm Springs Foundation is practically a by-work in poliomyelitis. This Foundation was started in 1927 and is a non-profit institution. It is supported mainly by gifts and some grants from other funds including the National Organization. President Roosevelt has had his life insured for more that a half a million dollars in favor of this foundation, which pays the premiums. This particular location for such an organization is interesting. Early in the settlement of Georgia, Warm Springs was a popular resort due to the warm springs gushing from the earth which provided a favority bathing place. Many years ago a young boy living near there was stricken with the dread poliomyelitis. When he later was able to be up he was anxious to be in the pool. In order to satisfy him his wishes were granted and he was allowed to play in the water. He found that in the water he could do many things impossible to do on land. This lad continued to swim daily and gradually improved to such an extent that people began to talk about it. President Roosevelt, a recent victim of poliomyelitis, heard of this spring and came to try it out. He too noted improvement and as a result purchased the land around the springs and established what is now Warm Springs Foundation Today this is probably the leading sanitarium for the treatment of poliomyelitis and cares for well over 100 persons continually.

The National Society for Crippled Children of the United

States of America, Inc. is a private organization whose purpose is to develop state societies for advancing the welfare of crippled children and to assist in the work in behalf of crippled adults. To this end the Society cooperates with all interested agencies, governmental or private, in establishing and carrying out its program of prevention, enumeration, legislation, hospital care and treatment, education, vocational guidance, rehabilitation and employment. This Society is vitally interested in every crippled person in the United States.

One of the most important programs today for the care of crippled children is that provided by the Social Security Act of 1935. The first State law which made provision for services on a state-wide basis was enacted in 1916.

By 1934, thirty-five states had made some provision for funds for the care of crippled children, although in several States the appropriations were so small that only a few children could be cared for. In August 1935, the Social Security Act became a law authorizing Federal grants to the states for services for crippled children to be administered by the Children's Bureau of the United States Department of Labor. The first Federal appropriation for this purpose made funds available for grants to the States on February 1, 1936, and the states then began to submit plans as required in requesting Federal Aid.

In the next four years services for crippled children under the Social Security Act were established in every State, the District of Columbia, Alaska and Hawaii.

Under the terms of the act which was last amended in 1939 , the sum of $20,000 is allotted by the Federal government to each State, and the sum of $1,830,000 is allotted on the basis

of the need in each State after the number of crippled children in need of care and the costs have been taken into consideration. This money (total $2,870,000) is given under approved State plans when matched by State funds. Another $1,000,000 is given to the States without matched funds according to the needs of the individual States.

This program is administered by the Crippled Childrens' Division of the Childrens' Bureau. This division has a medical director, orthopedic director, medical-social worker and public health nursing staff to provide consultant service to the States. Each year the State submits a plan to the Federal government and sends in regular reports. This program provides for care to every crippled child according to the individual needs. The State has or conducts a number of clinics throughout the state in which the crippled children are seen by specialists and recommendations are made for their treatment. If necessary the state pays for the necessary care. Thus every crippled child in the United States should in the very near future be adequately treated and rehabilitated.

Part Seven

CONCLUSION

The following article, I believe, summarizes very well the place the crippled child has a right to have in society.

"1. Every child has the right to be well born; that is to say, the right to a sound body, complete in its members, physically whole. In the securing of this right we pledge ourselves to use our influence that proper prenatal, intra-natal and post-natal care be provided to the end than congenital deformity, insofar as it is humanly and scientifically possible, be prevented.

"2. Every child has the right to develop under clean, wholesome, healthful conditions. In declaring this right, this Society undertakes to use its influence to the end that children everywhere, through proper legislation both local and general, and through proper supervision and protection, may grow to manhood and woman hood free from crippling conditions caused by insufficient nourishment, improper food or unsanitary environment, and free, so far as possible, from danger of accident, wounding or maiming.

"3. Notwithstanding the rights of children to be well born and to be protected throughout childhood, it is recognized that in spite of all umna precautions there will be, unfortunately, some crippled children. These we declare to have the right to the earliest possible examination, diagnosis and treatment, recognizing, as we do, the fact that many thousand cases of permanent crippling may be eliminated by early and effective care.

"4. Every crippled child has the right, not only to the earliest possible treatment, but to the most effective continuing care, treatment and nursing, including the use of such appliances

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as are best calculated to assist in remedying or ameliorating its condition.

"5. Every crippled child has the right to an education. Without this, all other provisions, unless for the relief of actual suffering, are vain.

"6. Every crippled child has the right not only to care, treatment and education, but to such training as will fit him or her for self-support, either wholly or partially, as the conditions may dictate. Without such practical application, education is likewise purposeless.

"7. Every crippled child has the right to vocational placement, for unless the child--boy of girl--after having been given physical care and treatment, and after being educated and trained, is actually placed in a proper position in the life of the World, all that has gone before is of noavail.

"8. Every crippled child has the right to considerate treatment, not only from those responsible for its being and for its care, treatment, education, training and placement, but from those with whome it is thrown into daily contact, and every possible influence should be exerted by this and affiliated organizations to secure this right, in order that, so far as possible, the crippled child may be spared the stinging jibe or the bitter taunt, or, worse still, the demoralizing pity of its associates.

"9. Every crippled child has the right to spiritual, as well as bodily development, and, without regard to particular religious or denominational belief, is entitled to have nourishment for soul growth.

"10. In brief, not only for ist own sake, but for the benefit of Society as a whole, every crippled child has the

right to the best body which modern science can help it to secure; the best mind which modern education can provide; the best training which modern vocational guidance can give; the best position in life which its physical condition, perfected as best it may be, will permit, and the best opportunity for spiritual development which its environment affords." 26

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26. The National Society for Crippled Children of the U.S. of America, Inc. The Crippled Child's Bill of Rights.

Prevalence of Poliomyelitis Since 1915 and the Present Situation.
Compiled by Brock C. Hampton, U. S. Public Health Report
Vol. 53, #27, p. 1145.

Year	Cases	Cases per 100,000 pop.	Deaths	Death Rates per 100,000 pop.
1915	1,634	3.1	691	1.0
1916	27,363	41.4	7,130	10.0
1917	4,082	5.4	1,182	1.6
1918	2,493	2.9	960	1.2
1919	1,932	2.4	747	.9
1920	2,385	2.8	769	.9
1921	6,266	6.9	1,597	1.8
1922	2,222	2.4	790	.8
1923	3,266	3.4	850	.9
1924	5,199	5.7	1,079	1.1
1925	5,926	5.6	1,519	1.5
1926	2,528	2.5	851	.8
1927	10,533	8.9	2,013	1.9
1928	5,133	4.6	1,381	1.2
1929	2,837	2.7	812	.7
1930	9,188	7.9	1,370	1.2
1931	15,790	14.6	2,096	1.8
1932	3,778	3.2	828	.7
1933	4,983	4.3	797	.6
1934	7,517	5.9	852	.7
1935	10,839	8.5	1,040	.8
1936	4,523	3.5	780	.6
1937	9,511	7.4	1,046	1.1
1938			487	.4

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